The plates printed by Prof. Kain were by formula No. 1, above given, which is stronger in iron than any of the others. The bright color of his plates for that class of work seems preferable to a darker color. The prints of butter and fat crystals exhibited by Dr. H. J. Detmers, of Columbus, O., at the present meeting, were produced by formula No. 4, furnished by Prof. A. H. Tuttle. The prints of diatoms exhibited by Hon. J. D. Cox, at the Cleveland meeting were, in all probability, produced by formula No. 3, as that formula is given in many books and is much used.

There is a method of cyanotype printing in which the paper is sensitized in a solution of an iron salt, and after printing developed in a solution of the potassium salt; but it is much more troublesome and no better than the usual method as above described.

THE GENERAL SESSION.

The exhibitors were promptly at their tables pursuant to adjournment. A printed programme had been distributed, giving briefly the work to be accomplished at each of forty tables arranged by those in charge about the spacious room, and most convenient for the large number of the Society and others who witnessed the work that interested them most.

Some for whom a plan had been prepared were not able to attend; in the following account of the individual work the members of unoccupied tables are omitted.

No. 1. Dr. C. M. Briggs, of Fairport, N. Y., placed a drop of fresh blood a little to the left of the center of the slide, and another slide, with the edge placed crosswise and at an angle, was drawn from left to right, thus wiping off most of the blood and leaving a thin layer of blood discs flatwise on the slide. This is allowed to dry, then the slide is placed on the turn-table, centered, and the blood turned down to a circle of the desired size. To stain the corpuscles, the slide is flooded with a solution of eosine and allowed to stand from three to five minutes, then flooded with water to wash it, and again allowed to dry, after which a small drop of balsam and benzole is placed on the slide, covered and heated cautiously. A little practice will enable anyone to mount blood nicely in this way.

No. 4. Mr. W. H. Brearly, Detroit, Mich., exhibited a portable holder for optical instruments.

No. 8. George E. Fell, M. D., Buffalo, N. Y., exhibited permanent preparations of the various forms of renal tube casts.

He described his methods of preparation, consisting simply in the making of a cell with liquid marine glue, rubber cement, or other suitable cement to confine the liquid, the natural medium rendered antiseptic by chlorine water.

The various forms of casts were shown, as the hyaline, granular epithelial, blood casts, etc., and their clinical significance commented upon.

No. 9. Charles S. Fellows explained his method of collecting, dissecting and mounting entomostraca as follows:

"For collecting I use a net made from fine cotton or silk mull. If I am collecting from a lake or pond where a boat can be employed, I use a net about fifteen inches in diameter and a yard long; this I fasten to a common dip-net ring, and with a strong cord tied to opposite sides of the ring hold it at the stern of the boat about half submerged, the boat at the same time being rowed at a moderate speed. This enables me to skim the surface, and also to capture forms that swim just below.

"When I think I have collected sufficient material I stop the boat, and by moving the net up and down in the water, withdrawing it more and more each time, all the collected forms will be found in the bottom of the net, and usually in one corner of the same.

"If I wish to preserve these alive I turn the net inside out (taking care to avoid spreading the collection over the sides of the net), and rinse the "catch" into a pail or wide-mouthed jar partly filled with water, I find very convenient for this purpose a 'Mason preserving jar.'

"If I do not care to preserve them alive, with the blade of a pocket-knife I scrape the forms from the net and rinse them off into a small wide-mouthed vial of about thirty per cent. alcohol, changing this when I arrive at home to seventy or eighty per cent.

"For small ponds and ditches where the water is shallow I use a small hand net made from a disc of mull about ten inches in diameter, bound round the rim with tape, and run on a brass wire ring eight inches in diameter. This will give a shallow net which works very well for ordinary occasions. To this ring I fasten a short

handle, and passing the net through the water back and forth, I can in a few minutes and with very little trouble obtain a good quantity of whatever microscopic life the ditch or pond contains. These I scrape off and bottle as previously described. I find very convenient to carry on such excursions a dozen four drachm vials (about two and one-half inches long and three-fourths of an inch in diameter). These I can easily carry in my vest pockets.

"For dissecting I use a short tube microscope with glass sliding stage, double nose-piece and one inch, half inch and fifth inch long-working apertures, A and B eye-pieces. I usually use inch and fifth; the inch when dissecting, and the fifth to turn down on the object in order to more clearly guide my eye as to the exact position of a part. In dissecting I place the object—for instance, a cyclops—in a very small drop of a mixture of glycerine, water and alcohol. I use for a "knife" a No. 13 sharp needle, put into a small wooden handle. I place the object under the inch objective with the back toward the point of the needle; I then cut it in two by pressing and working the needle point back and forth between the maxillipedes and first pair of feet; this divides the body into two nearly equal parts. Now taking the part containing the feet, turn it on its back and with the point of the needle turn the first pair of feet over the cut in the body,—these can then be cut off in manner already described. I have ready a number of slides labeled and marked with the names of the several parts of the cyclops. I take up with the needle the feet just cut off and place them in a drop of the glycerine medium on its appropriate slide; I continue in this way till all the feet are removed. I then commence on the anterior part—turning over and cutting off first the maxillipedes; then the antennæ and antennites. This leaves the mouth parts: labrum, mandibles and maxilla; to dissect these requires experience and a perfect understanding of the external anatomy of the object, a steady hand, sharp eye and, above all, patience. In this work I find a good use for the half and fifth inch objectives—the former to use when I am cutting and the latter to turn down occasionally to more clearly inform me of the exact position of the various parts.

"I am now ready to mount. I have ready my slides; clean, warm (not hot) and labeled. My glycerine jelly in a wide-mouthed,

capped balsam bottle in the mouth of which is suspended, from a disc of card-board, a small camel's-hair brush entering the jelly not more than one-fourth inch. This jelly bottle is kept warm by placing it in a dish of hot water.

"I place upon the center of the slide with the brush a small drop (experience will soon teach one to regulate the quantity) of the jelly. In this I place the object, arrange it properly under the microscope—then with a pair of forceps carefully place the cover, *edge first*, on the jelly. If everything appears right I hold it a moment over the flame of a lamp, when the cover settles in place without materially changing the position of the object. Now, with a maltwood finder, ascertain the true position of the object, mark it on the slide, and all is done but cleaning.

"I usually allow my slides to remain some weeks before cleaning or ringing, but they can be cleaned almost immediately under a running faucet of cold water and then rung up with gold size or shellac.

"In collecting Ostracoda and Cladocera, I dredge or skim the mud from the bottom of ponds or ditches, and while the large net is in the water nearly submerged pour the mud through a coarse sieve into it. By careful rinsing I can obtain the Crustacea almost free from mud; then preserve as in the case of the surface skimmings."

No. 10. Mr. E. H. Griffith explained how to entertain with the microscope, using common objects within the reach of every one.

No. 11. Dr. Salmon Hudson exhibited forms of bacteria from excretions of the human body.

No. 12. Dr. Lucien Howe, M. R. C. S., Buffalo, N. Y., illustrated the cultivation of bacteria. These minute germs, as they are often called, we breathe, and eat, and drink by thousands. Even the microscope cannot magnify them sufficiently to make all of their forms distinguishable. More depends upon their manner of growth, under different circumstances, than upon their appearance. Dr. Howe, therefore, demonstrated the method of cultivating those forms of bacteria which produce disease, especially such as infect the eye. He showed: first, how to make the "culture medium" or soil on which to plant the different forms, this being composed principally

of gelatine and beef broth. Then, how the bacteria taken from the eye were sown or inoculated, and how the minute forms looked when comparatively large masses were in active growth; especially, how the temperature was regulated in a suitable oven, in order to favor their development. Finally, the effect of these bacteria was shown upon a living rabbit. One eye of this animal had been touched with one form of disease-bearing germ, and as a result a severe inflammation or ulcer had resulted, which, however, was being rapidly healed. As human beings will not consent to have the effect of suitable remedies tried upon themselves, the only way of discovering the cure of each disease, is by these experiments in the culture of bacteria, and observation of the effects produced.

No. 13. Dr. Frank L. James, Ph. D., M. D., St. Louis, Mo., exhibited his method of making mirrors by the deposition of pure silver upon glass, after the formula made known by him several years ago and published in the annual Proceedings of the American Society of Microscopists for 1884 (Rochester meeting). It is a very rapid method of making mirrors, and is very useful to the microscopist in many ways. The pure silver mirror reflects 96 per cent. of the light received by it, while those made by the old mercurial amalgam process reflect but 64 to 65 per cent. The latter method is also highly injurious to those who habitually use it, producing all the terrible effects of mercurial poisoning—a fact which led to the adoption of the method of pure silver in Bavaria several years ago.

Dr. James also exhibited his method of preparing and using his well-known cement, illustrating the process of cell-building and finishing. The remarkably fine effects produced by these cements have been admired by all the microscopists who have ever seen them. The result attained by a careful blending of harmonious colors makes a finish that is unapproachable by any other method at present in use.

No. 14. Rev. Francis Wolle, of Bethlehem, Pa., author of "The Desmids of the United States," exhibited three slides of fresh-water algæ: (1) *Batrachospermum atrum*, a small variety of *B. moniliforme* from spring-waters; (2) *Bulbochæte intermedia*, a small branching alga, full of ripe fruit, the whole scarcely so large as to cover the top of a pin's head; (3) *Clostereum lineatum*, a desmid in a state of conjugation and bearing fruit, nearly matured.

15. Prof. A. Y. Moore, M. D., Cleveland, Ohio, explained the method of correcting objectives for spherical and chromatic aberrations by the use of test objects, and gave directions for such corrections when the object was not of the nature of a test. He also exhibited to interested persons his mercurial test-plates which are among the most delicate tests for the optical perfections of objectives.

No. 16. Henry Mills, Buffalo, N. Y., exhibited microspectroscope showing, by way of illustrating its use, the absorption bands of various substances. He also exhibited a variety of fresh-water sponges, some of which were taken from Chautauqua lake a few hours before.

No. 17. Dr. F. S. Newcomer illustrated his manner of separating diatoms from sand, etc., and arranging them with the mechanical finger. [This method is given at page 128 of this volume.]

No. 20. Prof. William A. Rogers, Hon. F. R. M. S., Waterville, Me., exhibited methods in micrometry and a microscopic metal thermometer by which the indicated temperature is read off upon the eye-piece micrometer of the microscope. This form of metal thermometer is that manufactured by the Standard Thermometer Co., of Peabody, Mass., and the micrometer attachment was constructed as a means of studying the real capacity of this form of thermometer. In a general way it may be said that its indications in this form have about the same degree of reliability as the best mercurial thermometers. Professor Rogers also exhibited a combined half-yard and half-meter upon a gold surface, a decimeter upon speculum metal, and centimeters subdivided into one thousand equal parts upon gold.

No. 21. At this table injected specimens were mounted in balsam by R. N. Reynolds, Detroit, Mich. The sections were transferred from commercial alcohol to oil of cloves, from the oil, one at a time, to a pad of tissue or clean blotting-paper, to remove the excess of oil, then a drop of benzole placed on the slide and the section laid on this drop; a drop of benzole balsam was next applied to the section, and before this drop of balsam spread out a cover-glass was laid on its rounded surface, thus preventing any air bubbles. The mount was then ready for drying, or for use under the microscope.

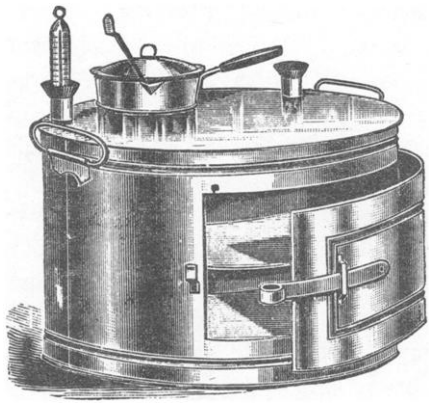
Human muscle containing Trichinæ was next mounted; he kept the stock of this material in glycerine, because it was then always ready to mount in glycerine; also, because alcohol makes this material too hard; he stated that Trichinæ did not show well when mounted in balsam. The muscle was cut into pieces about one-quarter of an inch long, a very small piece of which was put into a drop of glycerine on the center of a slide; a knife-blade was pressed against the muscle, lengthwise of the fiber; next a needle point was run down the blade of the knife so as to pierce the muscle at the knife edge, the needle and knife were drawn apart, separating but not cutting the muscle fibers; this was repeated with the different portions until many fine fibers represented the original piece; the fibers were scattered over a space of about one-half inch diameter, to which another drop of glycerine was given; then a five-eighths-inch cover-glass was placed edgewise against the slide, the forceps placed against its lower edge, while the top, supported by a needle, was slowly lowered upon the specimen. In case of a vacant space under the cover it was filled with glycerine; any glycerine remaining uncovered was removed by a camel's hair brush dampened with water. The cover was then centered on the turn-table, and heat applied to drive off moisture left by the brush. White zinc cement, well thinned with benzole, was applied with a number eight red sable brush, while the turn-table was in rapid motion; the brush, not too much filled with the cement, was brought to bear against the slide, just outside of the cover, then gradually and lightly drawn in until the edge of the cover-glass was cemented. The mount was then laid aside for the cement to set, after which two or three more coats of cement, not less than one day apart, should be applied to complete the mount. It is quite important that no glycerine should be allowed to touch the top of the cover-glass, because it is difficult for an unskilled hand to remove such and clean the cover.

No. 22. Dr. James E. Reeves, Wheeling, W. Va., gave an explanation of his method of cutting and mounting sections; he also exhibited several devices of his own for that purpose. Dr. Reeves' method may be told as follows:

First—The specimen is hardened in the usual manner—either in alcohol, Müller's fluid or chromic acid mixture.

Second—Having been perfectly dehydrated in absolute alcohol, it is next placed in spirits of turpentine or benzole to clear up,—say from a half hour to twelve or twenty-four hours, according to size and density of the specimen (the size should not, ordinarily, exceed three-fourths of an inch square by one-fourth of an inch in thickness).

Third—From the turpentine or benzole it is immersed in melted paraffine which must not exceed 140° F. It must be of first quality or the best paraffine, and merely exposed to sufficient heat to liquefy it. The specimen should be thus soaked until it is thoroughly permeated. The accompanying illustration will show the water-bath and oven devised by Dr. Reeves.



Fourth—Next make the cast. Pour upon a small piece of writing-paper—say a physician's prescription blank—a little of the melted paraffine, and set upon it the specimen just lifted from the paraffine cup. In a moment it firmly adheres to the film of paraffine on the paper; then set over it a mould (a section of tubing ofany kind) and pour into it the paraffine until full to running over. When cold enough to be pushed out of the mould the cast is ready for the microtome.

Fifth—By the aid of the section flattener the sections are nicely and completely spread out on the blade of the knife, from which they may be caught up and handled with delicate forceps.

Sixth—The next step places the section on the slide which a moment before has been given a thin coating of oil of cloves two and one-half parts and collodion one and one-half parts, by means of a camel's-hair pencil. The section may be pressed and smoothed upon the slide by covering it with a bit of tissue paper and using the thumb. Expose the slide, with the section thus fixed, to a temperature of 120° or 130° F., in the oven of the water-bath for

five or ten minutes, after which immerse the slide in spirits of turpentine or bezole to get rid of the paraffine in the section, say for ten or twenty minutes; then with 95 per cent. alcohol to get rid of the turpentine; then into the stain; then decolorized and washed in acid alcohol (if carmine is used); then into absolute alcohol for a moment; then into pure benzole to clear up the section; then a drop of balsam and zylol; and then the covering-glass.

[For more complete details of "How to Work," the reader is referred to a little pamphlet written by Dr. Reeves for the Bausch & Lomb Optical Company, and published since the Chautauqua meeting. In that publication his methods of differential staining and mounting of bacteria are given, including all the formulæ employed by him.]

No. 26. H. E. Summers, Ithaca, N. Y., exhibited serial section cutting with Bausch & Lomb's microtome.

No. 27. E. H. Sargent and B. L. Oviatt, of Cornell University, showed the injection of a cat. The object of the injection is to show the blood supply of the tissues injected. In the operation the difficulty to be overcome is to have the vessels relaxed, and at the same time kill the animal without pain. The blood-vessels can be relaxed by the use of nitrite of amyl; but as this causes pain, the animal was first made entirely insensible by ether, then the animal was allowed to inhale the fumes of the nitrite of amyl until the heart was still. After this the cat's abdomen was opened. The first thing injected was the small intestine; by inserting the canula into the superior mesenteric artery; the intestine with the blood-vessels was tied at the cœcum and at the duodenum. This prevents the injecting mass from spreading over too large an area, and so makes it possible to obtain a greater pressure. Next the superior mesenteric vein was cut to allow the blood to escape. After forcing in the mass until it begins to come out of the vein, this is tied and the injection continued until the artery is sufficiently tense. Next the head is injected by inserting the canula into the aorta and tying the sternal vein and artery, the azygous vein, and the arch of the aorta, also cutting the præcava, and injecting in the same manner. After the injection was completed the injected parts were transferred to cold water to prevent diffusion of the mass, then transferred to strong alcohol where it may be kept indefinitely.

No. 28. Dr. Charles Shepard, Grand Rapids, Mich.; the mounting of opaque slides, minerals, etc.

No. 29. Prof. M. L. Seymour, of the Illinois Normal University at Normal, and Miss Myrtle Crawford, of Bloomington, Illinois, cut and distributed to the members sections of various kinds of vegetable and animal tissues. The instrument was immersed in water and the sections were cut of various thicknesses, and at a rate of ten to forty-six per minute. The instant a section was cut it floated upon the water, thus revealing to the eye its value. They were taken up by camel's-hair brushes.

No. 30. Dr. Thomas Taylor, microscopist of the United States Department of Agriculture at Washington, exhibited about fifty specimens of fats, consisting of butter from several states, and made from several breeds of milch cows, showing in each case that when the butter is not boiled crystals are not observed. Butter in this condition appears under polarized light and green selenite plate as if pure oil was under the object-glass, showing not even a trace of prismatic colors. To gratify the visitors, Dr. Taylor mounted one set of slides with lard, and aother set with pure butter; the difference was marvelous. The lard appeared brilliant with spinous or star-like forms of every hue of the rainbow, while the pure butter appeared of pure, even brilliant, green colors, at once showing the difference between unboiled fresh butter and boiled lard. As a test of his power to demonstrate the presence of lard crystals in oleomargarine, Dr. Taylor mounted many specimens of this butter substitute in the presence of the visitors, most of them professionals, and in each trial demonstrated in a moment that the substances under trial were all oleomargarine, since in each case the lard crystals were observed in abundance. Dr. Taylor remarked that had he boiled all the specimens in advance it would have taken from one to two weeks to have shown the presence of lard in these specimens; whereas, by making the examination with the samples as purchased, he could inform an officer of the law within five minutes whether to prosecute or not. Newly made oleomargarine should be put in a warm place to crystallize, as when newly made the ice chilling to which it was subjected during the process of making prevents crystallization. Dr. Taylor also exhibited typical crystals

of butter in all its conditions, and lard and beef fats, to show that crystals of beef fat may be distinguished from lard crystals, and these from butter or other fats. Dr. Taylor had an excellent photograph of the fat crystals made on the grounds by Mr. Walmsley, showing their branched and foliated character in contradistinction to lard, which is strictly stellar, and these again differing from the butter crystals in several particulars.

No. 31. At this table Mr. C. M. Vorce, of Cleveland, O., exhibited various adulterations of food, such as coffee, starch, sugar, baking powder, spices, etc. Also, the pure substances and specimens of the adulterants, and showed how the pure might be distinguished from the impure, and how the various adulterants may be detected and distinguished. Some simple tests were described which may be of use to housekeepers, and can be applied without a microscope. Chicory in coffee may be detected by putting a little into cold water; pure coffee will nearly all sink at once, and the water will not be colored for a long time. Chicory, if present, will mostly float at first, and the water will be immediately colored reddish and will, on shaking, take on a pronounced red color. Ground peas in coffee can scarcely be detected without a microscope. Baking powder can be tested for starch by putting a small quantity into a long slender vial and filling it with water; if strictly pure it will all dissolve, if starch is present a sediment will remain. To test for alum the fluid so obtained is poured into an equal quantity of milk diluted with its bulk of water, and the whole is heated to nearly boiling or even boiling; if alum is present a curd will be produced in the milk. Most of the adulterations of spices, etc., require for their detection the use of the microscope.

No. 33. Mr. Eugene A. Rau, of Bethlehem, Pa., exhibited the following mosses: Fruiting specimens of *Ephemerum crassinervium*, one of the smallest of this order of Cryptogams, the length of the entire plants measuring but a sixteenth of an inch. The dark red, double peristome of *Fontinalis Sullivantii*, and a leaf of *Mnium cuspidatum* were also shown giving evidence of some of the beauties of this interesting order of plants.

No. 34. James E. Whitney, F. R. M. S., Rochester, N. Y., illustrated the making of wax cells. These are punched from sheet wax of various colors, and after being attached to the glass slide, the

edges of the cell are beveled and smoothed by using an ordinary turn-table rapidly and holding the edge of a sharp knife against the wax. The use of the wax for this purpose has heretofore been usually condemned, because the volatile matter of the wax is apt to condense on the under side of the cover-glass, and obscure the view. By the device of coating the inside of the cell heavily with cement Mr. Whitney overcomes the difficulty by preventing evaporation, and has mounted a large number of slides within a few years without a single case of failure. By using rings of various colors in forming a single cell, the edges of the cell when beveled present the several colors in regular order without the use of any colored varnish.

No. 35. Mr. Charles Wellington, Jackson, Mich., assisted by Mrs. Wellington, illustrated cell making, mounting in cells, etc.

No. 36. Charles E. Alling, F. R. M. S., Rochester, N. Y., exhibited a rapid method of double staining vegetable sections with aniline green and carmine. In this process a weak solution of tannic acid is used as a mordant; its effect being to render the stain more rapid in its action, and preventing the colors washing out during the process of clearing and mounting.

No. 37. S. Winsor Baker, of Jamestown, N. Y., made wax cells by building up layers of artist's wax on the glass side, which was placed on the turning-table, and a cut made through the first layer of wax, the size of the cover-glass intended to be used, and the center taken out; a cut was then made with a needle a little inside of the first cut, extending down to the glass; the center was then removed and another cut made through to the glass a little outside of the first cut, leaving a wall of wax to form the cell, which was finished by smoothing with a piece of ivory, shaped like a chisel, and thoroughly varnishing, inside and out, with Brown's cement, making, when done, a very complete and beautiful cell for the object to be mounted.

Mr. Baker explained how different colored wax can be used as a guide for cutting out the layers of wax. He showed how, by using dark colored wax for the first sheet next the slide, and leaving it as a bottom to the cell, a background can be made to suit any object.

No. 39. L. R. Hartman, Fort Wayne, Ind., exhibited methods with diatoms.

No. 40. Dr. S. W. Dennis, San Francisco, Cal., exhibited tooth sections.